Network-Centric Computing: A New Paradigm for the Military?

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ABSTRACT

This paper investigates the optimal way to implement ultra thin computer architecture into the existing Information Technology for the 21st Century (IT-21) infrastructure. Factors studied include system architecture, the effect of limited communication capabilities of naval units, changes to current battle group operating doctrine, and the benefits and risks of introducing this new capability to the Fleet.

INTRODUCTION

Network-centric warfare has been defined "as an information-superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self synchronization. In essence, network-centric warfare translates information superiority into combat power by effectively linking knowledge entities in the battlespace."[1]

This paper discusses technology known as ultra thin clients (UTCs) and how to make information delivery more reliable and less expensive through the use of "display appliances" using a network-centric computing (NCC) architecture. The NCC approach is targeted to making information delivery simple and inexpensive. It is not a Windows-only or a UNIX-only approach, nor is it a Web browser approach that proposes to replace the inventory of existing legacy commercial off-the-shelf and government off-the-shelf applications with Web applications. The delivery of a wide variety of applications to the user is accomplished by using the network to allow servers to run applications for multiple users. Runtime environment requirements are thus confined to the servers and not propagated to all clients. Clients need only be able to accept redirected screen displays for the applications.

The main points are:

- Servers are categorized as either generic network servers or specific application hosting servers.
- Both categories of servers rely on the concept of being scaleable and taking advantage of technology to service many users.
- Clients are thin or ultra thin, relying on no application-specific code.
- Clients are not dependent on any specific operating system or hardware design.

The NCC deployment is simplified because the applications themselves are not deployed to the clients who represent the greatest number of users. For example, on a carrier with 1000 seats, there is a 1000:1 reduction in application software update costs, one application server vs. 1000 clients. Configuration management is simplified because the UTCs are zero-administration devices; all management is done at the servers. Low total ownership cost naturally follows because of the greatly reduced

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14. ABSTRACT
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configuration management and network administration. High service levels are provided to the users because all applications are available over a redundant network architecture with redundant application servers that can be accessed at any UTC on the network by using smart cards.

The NCC architecture shown in Figure 1 depicts how, by using clusters of network and application servers, the display information required can be pushed out to the end user.

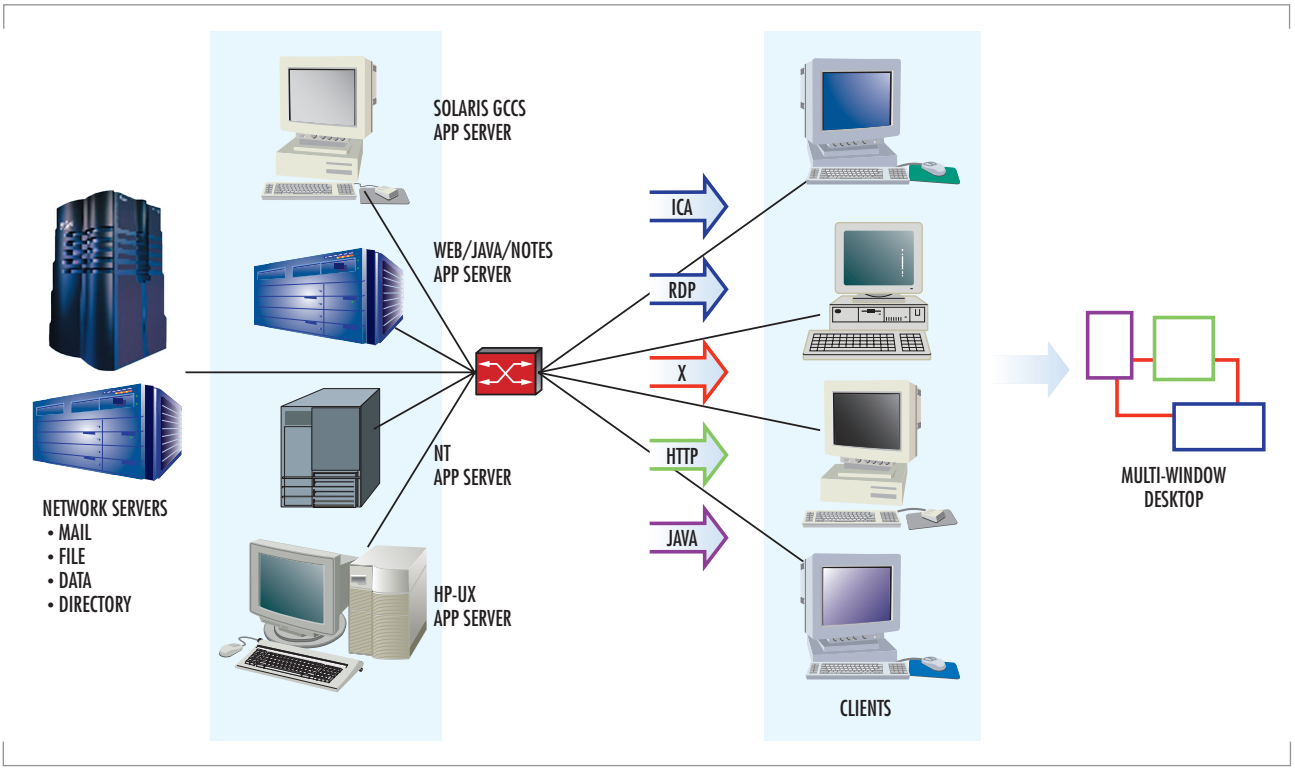

FIGURE 1. NCC architecture.

The NCC architecture has been implemented onboard USS *Coronado's* (AGF 11) Sea Based Battle Lab (SBBL) and has demonstrated the ease and flexibility with which it can be integrated into the existing Information Technology for the 21st Century (IT-21) Integrated Shipboard Network System (ISNS) local-area network (LAN). The current installation consists of 54 UTCs with seamless access to the ISNS backbone for e-mail and office automation, but it also provides access to the Global Command and Control System–Maritime (GCCS–M), GCCS–A (future capability), and Theatre Battle Management Core Systems (TBMCS) (future capability) at the users' desktops, as shown in Figure 2. Figure 3 further depicts the concept of consolidated servers. Additionally, as a natural feature of the UTC, users are no longer "tied" to their PC; they can use their smart card at any of the 54 clients and have full access to all their personal files and network applications.

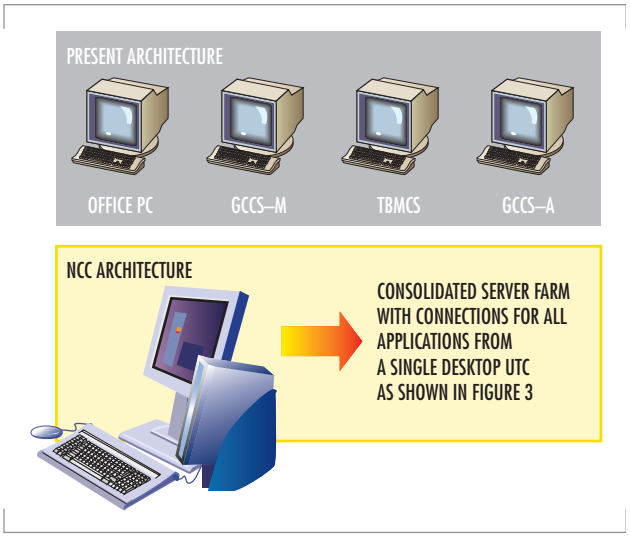

FIGURE 2. NCC desktop environment.

As an example, here is a brief illustration of a user's experience with the UTC architecture. Authentication happens once, when a user initially logs on the system by inserting their smart card into the slot on the UTC. There is no wait and no boot-up! The user is immediately connected to the server of their choice and has full access to the programs and files as they were left at the last logoff. The user begins working on a presentation to be given that afternoon and after a few minutes gets a call from the boss asking to see the current presentation. Prior to having a UTC, the user would have had to e-mail the draft plan or save it on a shared network drive; now, without even closing the file, the user removes his or her smart card, walks over to the boss's desk and reinserts the smart card. They are now both immediately looking at the current document, and any changes that are made are saved to the user's file either in a personal directory that only the user can access or on a shared directory to allow for additional collaboration.

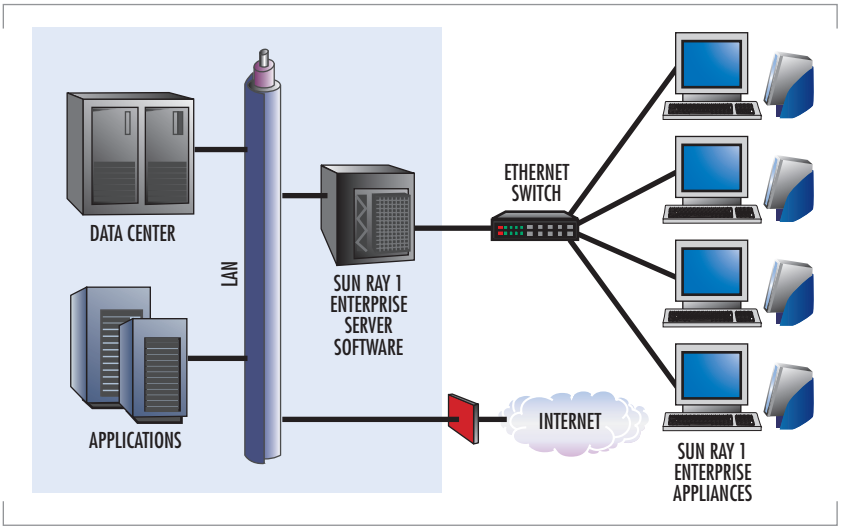

FIGURE 3. Consolidated Server Farm (from Aberdeen Group, September 1999).

As stated in Joint Vision 2020, "the overarching focus of this vision is full spectrum dominance—achieved through the interdependent application of dominant maneuver, precision engagement, focused logistics, and full dimensional protection. Attaining that goal requires the steady infusion of new technology and modernization and replacement of equipment."[2]

To meet this overarching focus with a "steady infusion of new technology and modernization and replacement of equipment" in an environment of shrinking budget resources, a radical shift from the current business model is required. The replacement and modernization of PCs to achieve this vision is impractical; thus, the UTC that never requires upgrading at the end-user location and only requires upgrades at the server level becomes the obvious choice for achieving Joint Vision 2020.

From the installation onboard the *Coronado* SBBL, it has become apparent that the users want more and more applications loaded in this architecture, which allows for the integration of legacy applications that previously required dedicated workstations or PCs. Those applications can now be accessed from any of the 54 UTCs on the network.

This architecture will mark the beginning of a new wave of computing; it is poised to redefine the distributed computing model of the networked fat client PC executing Web-based applications. Although network computing always requires computers, applications, and data, the UTC efficiently repartitions the system and redefines what goes where. By removing all computation and state information from the desktop, we truly have a zero-administration client that can help us achieve Joint Vision 2020 and reduce one of the costliest elements of information technology management.

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Current Research: Ultra thin client computing; multi-level security, Jini technology integration.

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